ANSWERS TO EVEN-NUMBERED PROBLEMS

MODERN COLLEGE PHYSICS

by

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CHAPTER 1

1–2. Horiz. 34 lb, vert. 20 lb

1–4. (a) 170 lb, 100 lb; −210 lb, 210 lb; −93 lb, −120 lb
(b) 230 lb at 55° above negative x-axis
(c) 230 lb, 55° below x-axis

1–6. 47 lb in negative y-direction

1–8. 232 lb, 17.8°

1–10. (a) 15 lb, 53° above the x-axis
(b) 26 lb, 28° below the x-axis

1–12. 5.65 units at 32° to the direction of **A**

1–14. 14 lb at 135° with $\mathbf{F}_1$

CHAPTER 2

2–4. (a) 50 lb
(b) 144 lb
(c) 57.8 lb, 28.9 lb
(d) 30 lb, 40 lb

2–6. (a) $T = 2000$ lb, $C = 1700$ lb
(b) $T = 1700$ lb, $C = 2000$ lb
(c) $T = 900$ lb, $C = 730$ lb
(d) $T = 2700$ lb, $C = 3400$ lb

2–8. (a) 4.6 ft (b) 220 lb

2–10. 1400 lb

2–12. 22 lb (normal force does *not* equal weight)

2–14. (a) 76 lb (b) 24 lb
(c) From 15.4 to 84.6 lb

2–16. (a) Pulled up
(b) 145 lb

2–18. (b) 0.25

2–20. (b) 10 lb (c) 30 lb

CHAPTER 3

3–2. 2 ft from light end

3–4. (a) −6 lb, 10 lb
(b) $\frac{5}{3}$
(c) 11.7 lb
(d) 2 ft from right end of bar

3–6. (a) 12 lb
(b) 53° with horizontal

3–8. $T = 800$ lb, $H = 640$ lb to the right, $V = 80$ lb downward

3–10. 1000 lb

3–12. (a) 43 lb
(b) 37 lb (c) 59 lb

3–14. (a) 20 ft
(b) 0.2 ft from center
(c) 1.25 ft

3–16. (b) Each guide exerts 200 lb

3–18. 19.3 ft

3–20. (a) 92.4 lb (b) 0.51

3–22. Center of gravity lies at a point on the perpendicular bisector of the line joining the 9-lb and 12-lb weights, at a distance of 0.6 ft from this line.

3–24. 7.4 in. from large end

CHAPTER 4

4–2. 5 cm/sec, −4 cm/sec

4–4. (a) 0, 1, 1.5, 2.5, 2.5, 2.5, 1, 0 ft/sec^2. Acceleration is constant only between $t = 6$ and $t = 12$ sec
(b) 10 ft, 23 ft, 2.5 ft/sec^2, 1 ft/sec^2, 0

4–6. (a) +1.5 ft/sec^2, right
(b) −1.5 ft/sec^2, left
(c) −1.5 ft/sec^2, left
(d) +1.5 ft/sec^2, right
(e) −4 ft/sec^2, left
(f) +4 ft/sec^2, right

4–8. 80 ft/sec

4–10. (a) 5 ft/sec^2 (b) 15 ft/sec

4–12. (a) 91.3 ft (b) 304 ft

4–14. (a) Yes (b) 1050 ft beyond the point of deceleration

4–16. 1500 ft

4–18. (a) 4.6 ft/sec^2 south
(b) 4.8 sec (c) 210 ft

4–20. (a) 56.6 ft/sec (b) 3.54 sec

4–22. (a) 67 ft above ground, 8 ft/sec upward; 68 ft above ground, 0 ft/sec; 64 ft above ground, 16 ft/sec downward; 32 ft above ground, 48 ft/sec downward
(b) 2.57 sec
(c) 66 ft/sec

4–24. 16 ft

4–26. (a) 24 ft/sec (b) 0.75 sec
(c) 0.38 sec (d) 6.8 ft

4–28. (a) 320 ft/sec (b) 400 ft

4–30. (a) 2.5 sec (b) 100 ft
(c) 2 sec (d) 3 sec
(e) 0 sec, 5 sec
(f) 1.3 sec, 3.8 sec
(g) 0.74 sec, 4.3 sec
(h) −32 ft/sec^2 always

4–34. Man in rowboat, 40 min
Man on shore, 30 min

4–36. 20° E on N, 170 mi/hr

4–38. (a) 0, 10 mi/hr westward
(b) 17 mi/hr downward, 20 mi/hr at 30° west of vertical

4–40. (a) 48.5° S of E (b) 2.65 mi/hr
(c) 0.38 hr

CHAPTER 5

5–2. 980 lb

5–4. (a) 2.5 cm, 1 cm/sec
(b) 20 cm, 2 cm/sec

5–8. (a) 5.55×10^{-4} sec
(b) 1.17×10^{8} dynes, 263 lb

5–10. (a) 59.0 n (b) const. velocity
(c) 6.25 m/sec

5–12. 0.114

5–14. 3600 lb

5–18. (a) 625 ft (b) 1000 lb

5–20. (a) 15 lb (b) 16 lb

5–22. 2.8°

5–24. (a) 6.9 ft/sec^2 (b) 17 ft/sec
(c) 110 lb

5–26. (a) 10 lb (b) 11 lb

5–28. (a) 5.1 n (b) 3 sec (c) 33 m
(d) 5.3 sec (e) 13 m/sec (f) only the answer to (a)

5–30. (a) 0.83 sec (b) 59 n

5–32. (a) 15 lb (b) 3.6 lb, 12 lb

5–34. (a) 327 cm
(b) 1.14×10^{5} dynes
9.8×10^{4} dynes
(c) 2.28×10^{5} dynes

5–36. (a) 3.27 m/sec^2
(b) 105 n (c) 210 n

5–38. $a_x = 2m_2g/(4m_1 + m_2)$
$a_y = m_2g(4m_1 + m_2)$

5–40. (a) 16 ft/sec^2 (b) 27 lb (c) 21 lb
5–42. 5 ft
5–44. g/μ
5–46. (a) 5.1×10^{-6} cm/sec^2 along the $\perp$ bisector of line joining A and B
5–48. 2.4

CHAPTER 6

6–2. (a) 6 ft (b) $v_x = 12$ ft/sec, $v_y = 16$ ft/sec
6–4. 0.13
6–6. (a) 0.44 ft (b) 1.8 ft (c) 4 ft (d) 16 ft
6–8. 1280 ft
6–10. (a) (after 2 sec) $x = 200$ ft, $y = 96$ ft, $v_x = 100$ ft/sec, $v_y = 16$ ft/sec; (after 3 sec) $x = 300$ ft, $y = 96$ ft, $v_x = 100$ ft/sec, $v_y = -16$ ft/sec; (after 6 sec) $x = 600$ ft, $y = -96$ ft, $v_x = 100$ ft/sec, $v_y = -112$ ft/sec (b) 2.5 sec (c) 100 ft (d) 5 sec (e) 500 ft
6–12. (a) 204 ft (b) 169 ft/sec
6–14. 17 ft/sec
6–16. (a) 90 cm (b) horizontally
6–18. (a) 1130 ft/sec (b) 1600 ft/sec, (c) 35 sec (d) 15,500 ft
6–20. (a) 144 ft (b) 48 ft (c) $v_x = 48$ ft/sec, $v_y = -32$ ft/sec
6–22. (a) 9.5°, 80.5° (b) 38.4 ft, 1370 ft (c) 3.1 sec, 18.5 sec
6–24. (a) 670 ft/sec (b) 2700 ft (c) $v_x = 530$ ft/sec, $v_y = 560$ ft/sec
6–26. (a) 80 ft/sec (b) 128 ft
6–28. (a) 32 ft/sec (b) 1 sec (c) 54 ft
6–30. (a) 66,700 mi/hr (b) 0.0193 ft/sec^2
6–32. 0.5
6–34. (a) 38.2 rev/min (b) 5 lb
6–36. (a) 0.27 (b) 15°
6–38. (a) 1530 ft (b) 1440 lb
6–40. 1.41 hr
6–44. 36,000 km above earth

CHAPTER 7

7–2. 470 ft·lb
7–4. (a) 40 ft·lb (b) −8 ft·lb
7–6. 25×10^8 ergs, 250 joules
7–8. 2×10^6 ft·lb
7–10. 7.35×10^6 ergs
7–12. (a) 130 ft·lb, 33 ft·lb (b) 2.1 ft·lb
7–14. (a) 160 ft·lb. It goes into kinetic energy (b) 160 ft·lb
7–16. (a) 16 lb (b) 320 ft·lb. It goes into gravitational potential energy
7–18. (a) 50 lb (b) 300 ft·lb
7–20. 16 ft/sec
7–22. 0.25
7–24. (a) 5000 ft, 10,000 ft (c) 2500 ft
7–26. (a) 8 ft/sec (b) 28 ft/sec^2
7–28. (a) $4g$ (b) g (c) $\sqrt{17}\,g$
7–30. $wa \sin\theta + \frac{1}{2}ka^2\theta^2$
7–32. 3.6 hp
7–34. (a) 3.7 cents (b) 5.4×10^5 ft·lb
7–36. \$2.98
7–38. 750 lb
7–40. (a) 33,400 ft·lb (b) 23,500 ft·lb (c) 1.72 hp
7–42. 73 ft/sec
7–44. 55,000 dynes
7–46. (a) $Gmm_E/6R$ (b) $-Gmm_E/3R$ (c) $-Gmm_E/6R$

CHAPTER 8

8–2. (a) 2.16 slug·ft/sec, 2.16 lb·sec (b) 1080 lb
8–4. (a) 1 ft/sec (b) 1872 ft·lb
8–6. (a) 7.20 ft/sec (b) 375
8–8. (a) 18 ft/sec (b) 125
8–10. (a) 50 cm/sec 53° below the x-axis in the fourth quadrant (b) 380,000 ergs
8–12. (a) Zero (b) 4 m/sec to the left, 1.5 m/sec to the right (c) 33 joules
8–14. 5 cm/sec, −25 cm/sec
8–16. (a) 5×10^6 ergs (b) 100 cm/sec (c) 10,000 cm/sec
8–18. (a) 10 ft/sec (b) 11 ft/sec (c) 8 ft/sec
8–20. (a) 0.0894 (b) 33%
8–22. 280 m/sec
8–24. (a) 0.16 (b) 240 joules (c) 0.32 joule
8–26. 596 m/sec
8–28. (a) 0.19 ft/sec (b) 1.3 lb
8–30. (a) 4 ft/sec (b) 2 lb (c) 25,000 ft·lb for bullets, 40 ft·lb for man

CHAPTER 9

9–2. 500 rad/sec
9–4. 16 ft/sec, 31 ft/sec, 47 ft/sec, 600 rev/min, 1800 rev/min, 5400 rev/min
9–6. −13 rad/sec^2, 57 rev, 3.3 sec
9–8. 7.5 sec
9–10. (a) 40π rad/sec (b) 132π rad (c) 600π in/sec (d) 14,000 in/sec^2
9–12. Resultant accelerations: (a) 15 cm/sec^2 (b) 65 cm/sec^2 (c) 126 cm/sec^2
9–14. (a) 200 ft/sec^2 (b) 200 ft/sec^2
9–16. (b) $1/\sqrt{12}$ rad
9–18. 3.54 in.
9–20. 11 $mL^2/16$, $0.478L$
9–22. (a) 0.132 slug·ft^2 (b) 0.284 ft
9–24. $w = 2\sqrt{g/3R}$
9–26. (a) 190 rev/min (b) 1.6 hp
9–28. (a) 18.8 lb·ft (b) 3000 ft·lb
9–30. (a) 60π lb·ft (b) $9000\pi^2$ ft·lb
9–32. (a) 12.2 lb (b) 9.6 lb (c) 9.42 sec
9–34. (a) 10 rad/sec^2 (b) 200 ft·lb (c) 6.15 rad/sec^2
9–36. (a) 21.3 lb (b) 52.3 ft/sec (c) 2.45 sec
9–38. (a) 10.7 ft/sec^2, 0, 5.33 lb (b) 4.57 ft/sec^2, 9.14 rad/sec^2, 6.86 lb, 4.57 lb
9–40. (a) 240 cm/sec, 320 cm/sec (b) 5×10^5 gm·cm^2 (c) 1600 cm/sec^2 (d) 780 cm/sec^2 (e) 51,000 dynes, tension
9–42. (a) 2 m/sec^2 (b) 9.8 newtons
9–44. (a) 12 rad/sec (b) 0.027 joule
9–46. $(mg \pm \mu Mg)/M\omega^2$
9–48. 0.08 rev/sec
9–50. (a) −0.04 rad/sec (b) 60 deg (c) 72 deg
9–52. (a) 2 slug·ft^2 (b) 2620 ft·lb
9–54. (a) 180,000 dynes (b) 4300 rev/min

CHAPTER 10

10–2. 8 ft/sec^2
10–4. (a) 600 lb (b) 0.02 ft
(c) 1200 lb
10–6. (a) Lower, 1.67×10^{-4}
Upper, 5×10^{-4}
(b) Lower, 0.004 in.
Upper, 0.012 in.
10–8. (a) Copper, 0.02 in.
Steel, 5.33×10^{-3} in.
(b) 0.105 ft·lb
10–10. (a) 70 cm from end A
(b) 60 cm from end A
10–12. $k = A(xA - v_0pk_0)/FV_0$
10–14. 64.32 lb/ft^3
10–16. (a) 700 lb/in^2 (b) 24×10^{-6}
(c) 2.4×10^{-4} ft
10–18. (a) $(E \cos^2 \theta)/A$
(b) $(F \sin 2\theta)/2A$
(c) 0° (d) 45°

CHAPTER 11

11–2. (a) 17.0 cm (b) —420 dynes
(c) 1.33 sec (d) —32.6 cm/sec
11–4. (a) 6 lb/ft (b) 0.91 sec
(c) 1.3 sec
11–6. (a) 31 cm/sec (b) 49 cm/sec^2
(c) 0.33 sec (d) 100 cm
11–8. 0.79 sec
11–10. $\frac{3}{4}$ kinetic, $\frac{1}{4}$ potential
11–12. All answers in ft·lb

	V	K	V_G	Σ
Lowest	32	0	0	32
Equil.	8	8	16	32
Highest	0	0	32	32

11–14. (a) 5.6 lb
(b) 13.6 lb, 8 lb, 2.4 lb
(c) 0.62 ft·lb, 0.077 ft·lb
11–16. (a) $2\pi/3$ sec
(b) 9.15 cm
(c) 0.09
11–18. (a) 2 ft/sec
(b) 4 ft/sec^2
11–20. 979.78 cm/sec^2

CHAPTER 12

12–2. (a) 120 ft/sec (b) 6 in.
12–4. 10^{-2} Y
12–6. (a) 132 cycles/sec
1320 cycles/sec
13,200 cycles/sec

CHAPTER 13

13–2. (a) Traveling (b) 4 cm
(c) 400 cm (d) 20,000 cm/sec
(e) 50 vib/sec
13–4. (a) 4×10^4 cm/sec
(b) 1.28×10^{10} dynes/cm^2
(c) 0.05 cm
13–6. (a) 50 cm (b) 87 cm
13–8. 3520 m/sec
13–10. 375 m/sec
13–12. (a) 8.79×10^{11} dynes/cm^2
(b) 0.24 cm
13–14. (a) 456 cycles/sec
(b) 463 cycles/sec
(c) 7 cycles/sec

13–16. (a) 1088 cycles/sec
(b) 1098 cycles/sec
(c) Almost 15 waves
(d) 1140 ft/sec
(e) 0.50 ft

13–18. (a) 11.4 ft
(b) 1.04 ft

CHAPTER 14

14–2. 13 lb/in^2
14–4. 5.75 lb
14–6. (a) 680 gm
(b) 7840 dynes/cm^2
14–8. 0.013 ft^3
14–10. (a) 0.426 (b) 0.46 of the height of the block
14–12. (a) 1.5 gm/cm^3
(b) 0.4 gm/cm^3
14–14. 12 lb/ft^3
14–16. 5.92 cm
14–18. (a) 0.33 ft (b) 3 sec
14–20. (a) 2.12 w lb·in
14–22. (a) 2.33 lb (b) 5.67 lb downward
14–24. (a) $\Delta h = La/g$

CHAPTER 15

15–2. 36×10^{-5}
15–4. 86.59 ft
15–6. 0.2506 in.
15–8. 1.3 in.
15–10. 2×10^{-5} (C°)$^{-1}$
15–12. 235 cm

CHAPTER 16

16–2. (a) 120,000 Btu/hr
(b) 280,000 Btu/hr (c) 47 hp
16–4. (a) 26,700 Btu (b) 68 ft^3
(c) 7.84 kwh
16–6. 19%
16–8. 87.6 watts
16–10. 23°C
16–12. 5.9, 5.9, 6.4, 6.6, 6.1 cal/mole·C°
16–14. 470°C
16–16. 0.107 cal/gm·C°
16–18. 100 gm
16–22. 0°C with 200 gm of ice melted
16–24. 5×10^4 cm/sec
16–26. 3.4 gm
16–28. 100 gm
16–30. 0.0399 lb
16–32. 357 m/sec
16–34. (a) 1600 ft^3 (b) 310 ft^3
16–36. 86,400 cal/day
16–38. (a) 1.8 cal/sec (b) 20 cm
16–40. 1.15×10^{-3} cal/sec·cm·C°
16–42. 110°C

CHAPTER 17

17–2. (a) No (b) yes
17–4. (a) No (b) yes (c) positive
17–6. 524 cal
17–8. $W = Q_2 - Q_1$

17–10. $U_1 = U_2$
17–12. (a) 59,300 ft·lb, 76 Btu
(b) 870 Btu
17–14. (a) 1.1×10^{-2} ft^3
(b) 650 ft·lb (c) 1800 Btu
(d) 1.4×10^6 ft·lb
17–16. 47°C
17–18. (a) 900 cal (b) 1600 cal
(c) 400 cal
17–20. (a) 6.6 (b) 0.64 kwh
(c) 3 cents

CHAPTER 18

18–2. (a) 350 gm (b) 27 gm
18–4. 740 cylinders required
18–6. (a) 0.88 atm (b) 1.33 liters
18–8. (a) 82 cm^3 (b) 0.33 gm
18–10. When the piston has descended 13.12 in.
18–12. 0.0023 gm
18–18. 4.00
18–20. (a) 1.91×10^3 m/sec,
1.76×10^3 m/sec,
1.56×10^3 m/sec
(b) 2.21×10^3 m/sec,
2.04×10^3 m/sec,
1.80×10^3 m/sec
18–22. (a) 1.26×10^{-19} m^2
(b) 3.15×10^6/m
18–24. (a) 2.24×10^{-7} m
(b) 2.99×10^{-7} m
(c) 2.24×10^{-9} m
(d) 7.84×10^9/sec,
6.82×10^9/sec,
7.84×10^{11}/sec
(e) 0.407
18–26. (a) 4.00×10^{-21} joule
(b) 2.19×10^3 m/sec

CHAPTER 19

19–2. (a) $F = 2q^2/4\pi\epsilon_0 a^2$, vertically upward
(b) $F = 2q^2a/4\pi\epsilon_0(a^2+x^2)^{3/2}$, vertically upward
19–4. (b) 0.12 μcoul
19–6. (a) 9×10^{22} m/sec^2
(b) 4.1×10^{16} rad/sec
19–8. (a) 0.092 n
(b) 1.318×10^{26} m/sec^2

CHAPTER 20

20–2. -3.92×10^{-5} coul
20–4. -25×10^{-9} coul
20–6. (a) 1.8×10^4 n/coul, neg. x-direction
(b) 8×10^3 n/coul, pos. x-direction
(c) 3.3×10^3 n/coul, 70°, second quad.
(d) 6.4×10^3 n/coul neg. x-direction
20–8. 8.85×10^{-13} coul
20–12. (a) 4.34×10^{-4} m/sec
(b) 2.74×10^{-4} m/sec upward
20–14. (a) 1.61×10^{-6} m
(b) 1.41×10^{-14} kgm
(c) 0.23
20–16. (a) 3.6×10^5 n/coul
(b) 6.3×10^{16} m/sec^2
20–18. (a) 1.42 cm (b) 9.8 cm
20–20. (a) 0.704 cm (b) arc tan 0.352
(c) 4.92 cm

CHAPTER 21

21–2. (a) Zero (b) -10^{-3} joule
(c) $+2.3 \times 10^{-3}$ joule
21–4. 9440 volts
21–10. 951 volts
21–12. (a) $v = \sqrt{2qV/m}$
(b) 5.93×10^{5} (c) 2500 volts
21–14. 8.70×10^{7} m/sec
21–16. (b) 2.30×10^{6} m/sec
21–18. 10.8 hp

CHAPTER 22

22–2. (a) 0.88 amp
(b) Direction of positive ion
22–4. (a) 10^{-4} coul/sec
(b) 4×10^{-6} coul/m^2
22–6. (a) 1.53 ohms
(b) 0.0958 ohm
22–8. (a) 1.315×10^{-4} ohm
(b) 0.234 m
22–10. 0.735×10^{-6} ohm
22–12. 1.0003 abs volts
22–14. 84.3%
22–16. (a) 22 ohms (b) 5.5 amp
(c) 157 cal/sec (d) 550 watts

CHAPTER 23

23–2. 28.97°C
23–4. (a) 24 watts (b) 4 watts
(c) 20 watts
23–6. 7.98 cm
23–8. (a) 25 volts (b) 2 ohms
23–10. (a) 0.5 ohm (b) 10 volts
23–12. (a) + (b) 1000 amp
(c) 9.9 ohms (d) 13 volts
(e) 1120 watts (f) 990 watts
(g) 120 watts (h) 6.7 cents
23–14. (a) 99.1 volts (b) 0.0527
23–16. (a) 2.83 volts (b) 1.33 volts
23–20. (a) 32 ohms (b) 20 volts
23–22. 9.6 watts in 60-watt lamp,
14.4 watts in 40-watt lamp
23–24. (a) 141 volts (b) 4.5 watts
(c) 2 groups of resistors in parallel, each consisting of 2 resistors in series
23–26. (a) 15 ohms
(b) 3.3×10^{-3} amp,
6.7×10^{-3} amp
23–28. (a) 8 ohms (b) 72 volts
23–30. $V_{ab} = 0.22$ volt

CHAPTER 24

24–2. (a) qvB along neg. z-axis
(b) qvB along pos. y-axis
(c) Zero
(d) $qvB/\sqrt{2}$ parallel to neg. y-axis
(e) qvB in yz-plane at 45° to neg. z-axis and to neg. y-axis
(f) $qvB\sqrt{2/3}$ in yz-plane at 45° to neg. z-axis and to neg. y-axis.
24–4. (a) 2.9×10^{7} m/sec
(b) 4.2×10^{-8} sec
(c) 8.7×10^{6} volts
24–6. 0.5 w/m^2 downward
$\parallel$ to y-axis

24–8. 3640
24–10. (a) 1.7×10^8 m/sec
(c) 0.48 m
24–12. 0.0213 m
24–14. (b) Yes
24–16. (a) Inner segment
(b) Outer segment
24–18. (a) 1.32 w/m^2
(b) 4.22 Mev,
2.01×10^7 m/sec

CHAPTER 25

25–2. (a) 6×10^{-3} n·m
(b) 8.07×10^{-3} n·m
25–4. (a) $F_{ab} = 1.92 \times 10^{-3}$ n outward
$F_{bc} = 2.16 \times 10^{-3}$ n outward
$F_{cd} = 1.92 \times 10^{-3}$ n inward
$F_{da} = 2.16 \times 10^{-3}$ n inward
(b) 1.73×10^{-4} n·m
25–6. (a) 0.013 w/m^2, upward
(b) 0.023 w/m^2, toward left
25–8. (a) 188 ohms
(b) 1.9% too low
25–10. (a) 0.1004 ohm
(b) 7475 ohms
25–12. New full-scale reading is 0.209 amp
25–14. 1 ma
25–16. (a) 2900 ohms (b) 0.833 ma
(c) 3000 ohms
25–18. 420,000 ohms
25–20. 250 ohms
25–22. (a) 270 volts (b) 67.5 volts
25–24. 10.9 volts, 109.1 volts
25–26. $R_1 = 0.0278$ ohm,
$R_2 = 0.250$ ohm,
$R_3 = 2.5$ ohms
25–28. (a) 0.80 amp
(b) 3.7 amp (c) 112.6 volts
(d) 417 watts
25–30. (a) 0.5 amp (b) 4 amp
(c) 108 volts (d) 60 watts
(e) 48 watts (f) 540 watts
(g) 71%

CHAPTER 26

26–2. (a) Zero
(b) 4.58×10^{-8} w/m^2
(c) 8.0×10^{-8} w/m^2
26–4. 2.4×10^{-20} n
26–8. 1.02 cm
26–10. 16 turns
26–12. 3.42×10^{-3} w/m^2
26–14. 6.00×10^{-4} w/m^2
26–16. (a) 0.301 w/m^2
(b) 398 amp·turns/m
(c) 99.83%
26–18. 8 amp
26–20. 13.6 amp·turns/m

CHAPTER 27

27–2. 3.14 volts
27–4. 0.866 volt
27–6. 0.006 volt
27–8. (a) Right to left
(b) Right to left
(c) Left to right
27–10. (a) From a to b
(b) From b to a
(c) From b to a
27–14. 3.77 volts
27–16. 0.41 volt
27–18. (a) 10^{-5} coul

CHAPTER 28

28–2. (a) 24 μcoul
(b) 1.44×10^{-4} joule
(c) 3.6 volts
(d) 1.30×10^{-4} joule

28–4. 0.860 cal

28–6. (a) 8×10^{-4} coul, 800 volts; 8×10^{-4} coul, 400 volts
(b) 5.33×10^{-4} coul, 533 volts; 10.7×10^{-4} coul, 533 volts

28–8. (a) 1 μf (b) 9×10^{-4} coul
(c) 100 volts

28–10. (a) 1000 volts (b) 2000 volts
(c) 5×10^{-4} joule

28–12. (a) 3.43
(b) 0.708×10^{-5} coul/m^2

28–14. (a) 40 volts
(b) 0.5 joule for air, 0.2 joule for other
(c) 0.3 joule

28–16. (a) 5.53×10^{-11} farad
(b) 0.0166 μcoul
(c) 2.49×10^{-6} joule

28–18. (a) 0.226 m^2 (b) 1250 volts

CHAPTER 29

29–2. (a) 12 μsec
(b) 2.53 volts

29–4. (a) 0.05 amp (b) 1 amp/sec
(c) 0.5 amp/sec (d) 0.23 sec
(e) 1.97×10^{-2} amp, 3.17×10^{-2} amp, 3.89×10^{-2} amp, 4.33×10^{-2} amp

29–6. 0.326 amp to right

29–8. (a) q (μcoul): 0, 400, 630, 870, 1000
(b) i (μa): 100, 60, 37, 14, 0
(c) 10 sec
(d) 6.9 sec

29–10. (a) 2.39 mh (b) 4.41 pf

CHAPTER 30

30–2. (a) 1.06×10^{7} ohms
(b) 2.12×10^{3} ohms
(c) 5.31 ohms

30–4. (a) 3770 ohms; 37,770 ohms
(b) 265 ohms; 26.5 ohms
(c) 15.9 cycles/sec

30–6. 16.7% decrease

30–8. 120 vib/sec

30–10. 8.51×10^{-5} h

30–12. 2760 volts

30–14. 3×10^{18} cycles/sec
6×10^{14} cycles/sec
3×10^{9} cycles/sec
3×10^{8} cycles/sec
10^{6} cycles/sec

CHAPTER 31

31–2. 1.586×10^{-5} in., 2.78×10^{-5} in.

31–4. (a) 36 cm^2 (b) Zero

31–6. 52,500 waves

31–8. 362 nm

31–10. 227 rad/sec

CHAPTER 32

32–4. 1.732
32–6. 13.4°, 27.1°, 41.7°, 58.9°
32–8. No
32–10. (b) 90°
32–12. 1.89
32–16. 30°
32–18. 52.3° for 400 nm
47.4° for 700 nm

CHAPTER 33

33–2. 50.1 ft
33–4. $s' = 100$ cm, $y' = 5$ cm, virtual, erect
33–6. 1.296 in.
33–10. 24 cm
33–12. 1.5
33–14. (a) 12 cm (b) 24 cm (c) −12 cm
33–16. 2
33–18. 33.3 cm
33–20. At center of bowl; $m = 1.33$

CHAPTER 34

34–2. (a) 43.7 cm from flat face (b) 1.712
34–4. (a) −20 cm (b) Virtual (c) 8 cm (d) Real, inverted (e) 0.6 mm
34–6. At vertex of silvered surface
34–8. 0.33 in. above page
34–10. (a) 15, 20, 30, −10 cm (b) −0.5, −1, −2, 2 (c) Real, real, real, virtual (d) Inverted, inverted, inverted, erect
34–12. (a) $s' = +120$ cm, −3 cm (b) 120 cm to right of second lens (c) 21.8 cm to right of second lens (d) 80 cm to left of second lens
34–14. 4 cm
34–16. 41 cm to right of lens; real, inverted
34–18. −7.2 cm
34–20. −15 cm
34–22. (a) 25 cm (b) Virtual
34–24. (a) 0.167 in. to right of previous focus (b) 23.3 ft

CHAPTER 35

35–2. (a) 5.5 (b) 180°
35–4. 2.945×10^{-4} rad
35–6. 36.7 fringes/cm
35–8. 1.4 mm
35–10. 17.5°, 36.9°, 64.1°
35–12. (a) 570 nm (b) 43° 10′
35–14. 0.048 mm

CHAPTER 36

36–2. 54° 44′
36–4. (a) 32° (b) 1.6
36–6. 355 nm, 396 nm
36–8. (c) 8.58×10^{-5} cm

CHAPTER 37

37–8. 7000 atoms
37–10. (a) 1.05 gm
(b) 1265 tons
(c) 110 lb
37–12. (a) 6200 A, 3100 A, 5510 A, 3440 A
(b) Cu, Zn
37–14. (a) 4.58×10^{14}/sec
(b) 6540 A
(c) 1.90 ev
(d) 6.62×10^{34} j·sec
37–16. 0.34 volt greater

CHAPTER 38

38–4. (a) 221 ft (b) 710 mi
(c) 540×10^{3} mi (d) Yes
38–6. 1.10×10^{-14} m
38–10. 4866.4 A; 4865.1 A; 4864.7 A
38–12. Lyman: 912 A, 13.6 ev,
Balmer: 3640 A, 3.40 ev,
Paschen: 8200 A, 1.51 ev,
Brackett: 14,550 A, 0.85 ev,
Pfund: 22,800 A, 0.54 ev
38–14. (a) 12.75 ev (b) 6
38–18. (a) 5.28×10^{45}
(c) 3.03×10^{-39} m

CHAPTER 39

39–4. (b) No (c) Yes
39–6. No
39–14. (a) 4.65×10^{-12} kgm
(b) 4.65×10^{-12}
39–20. (a) 6.84×10^{3} volts
(b) 1.26×10^{7} volts
39–22. 9.0×10^{16} joules,
2.5×10^{10} kwh
39–24. (a) 8.03 amu
(b) 7.47×10^{3} Mev
(c) 17.3 Mev,
1.86×10^{-2} amu
39–26. (a) 1.73 Mev (b) No
39–28. (a) 25.8×10^{-31} kgm
(b) 2.81×10^{8} m/sec
(c) 0.038 w/m^2 normal to the trajectories

CHAPTER 40

40–2. (a) 0.98 A, 980 XU
(b) 20°20′
40–4. (a) 355 cal/sec
(b) 33.8C°/sec
40–6. (a) 24, 29
(b) Cr, Cu
40–8. (a) 10.4 kev, 69.4 kev, 77.8 kev
(b) 77.7 to 80.0 kev
40–18. (b) No
40–20. (a) 570 ev
(b) 0
(c) 44°2′; no recoil
40–24. (a) 1.15×10^{18} ohms
(b) Marked decrease

CHAPTER 41

41–8. (a) 2.00×10^{-23} A
(b) 1.77×10^{-25} A
(c) 4.00×10^{-31} cm, 3.54×10^{-33} cm
41–10. (a) 1.8×10^{-3} joule
(b) 1.7×10^{30}
(c) 3.5×10^{-30} cm
(d) No
41–12. (b) Long; yes
(c) Yes

CHAPTER 42

42–2. (b) $0.368\ I_0$
42–4. 0.305
42–8. 6.48×10^{-4} gm
42–10. (a) 0.368
(b) 0.632
42–14. (b) 2
(c) 8.6×10^{-4}/sec, 1.51×10^{-4}/sec
(d) 13.4 min, 76 min
42–16. (a) 3.00×10^{6} gm
(b) 1.29×10^{-2} gm
(c) 3.10×10^{-15} gm
42–18. (a) 1.05×10^{-4} gm, 6.65×10^{-10} gm
(b) 0.103 mc, 3.81 rd
42–20. 3.62×10^{5} ft^3
42–22. With calcium
42–24. 6840 mr/hr

CHAPTER 43

43–4. (a) 1.60 (b) 4.92 Mev
43–6. 3.12×10^{7} m/sec
13°20′ downward
43–8. (a) 8 (b) 52 (c) 910
43–10. 16.6 Mev
43–12. (a) 17.3 Mev
(b) 9.0 Mev
(c) 8.76 cm
43–14. (a) —1.20 Mev
(b) 5.92 Mev
43–16. 1410 yr
43–18. (a) 19.4 yr
43–20. 1.77 mgm
43–22. (a) 2.23 Mev, 1.12 Mev; 28.3 Mev, 7.07 Mev; 492 Mev, 8.79 Mev
(b) Supply 28.3 Mev

CHAPTER 44

44–4. (a) 1.17×10^{-7}
(b) 6.56×10^{-5}
(c) 560
44–6. (a) H, 0.022/cm; B, 0.147/cm; O, 6.82×10^{-6}/cm
(b) 0.169/cm
44–10. (a) 1.07×10^{19} j/min
(b) 2.36×10^{28} j/min
(c) 4.10×10^{10} tons/min
(d) 2.88×10^{8} tons/min
44–12. 1.18×10^{16} km